Angewandte Chemie
Eine Zeitschrift der Gesellschaft Deutscher Chemiker

Supporting Information

69451 Weinheim, Germany

Probing the Charge Build-Up and Dissipation on Thin PMMA Film Surfaces at the Molecular Level by XPS**

*Eda Yilmaz, Hikmet Sezen, and Sefik Suzer**

anie_201201351_sm_miscellaneous_information.pdf

SUPPORTING INFORMATION

As also mentioned in the main text of the manuscript, we can estimate the MMA monomer density of the PMMA using the bulk density of 1.2 g/cm^3,[1] to be ~4x10^{14} units/cm^2 on the surface, which reveals that approximately 1 out of 10^4 monomer units carries a surface charge. This also tells us that a monomer unit occupies an area of ca. 0.5 x 0.5 nm. For the total of 10^4 monomer units we obtain an area of 50 nm x 50 nm as shown in Figure S1 below.

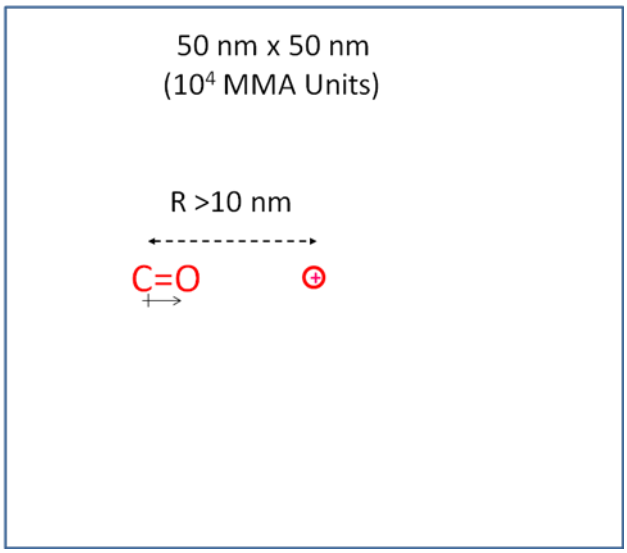

Figure S1. Schematic representation of the carbonyl dipole interacting with a point charge ca. 10 nm away.

For a simple ion-dipole interaction, by considering the carbonyl group having a dipole moment of ~1 D interacting with a unit charge ~10 nm away, the interaction energy can be estimated using the equation given below:[2]

$$\Delta E = - \mu \, . \, Q / (4\pi \, \varepsilon_0 \, \varepsilon \, R^2)$$

Where, R is the average distance between the dipole and the charge (taken as 10 nm), μ is the dipole moment (taken as ~1 Debye), Q is the unit charge, and ε is the dielectric constant of the PMMA film (taken as ~2). This equation yields only 10^{-4} eV, too small compared to the observed energy of 0.07 eV.

[1] R. C. Weast, M. J. Astle, W. H. Beyer, *CRC Handbook of Chemistry and Physics*, 55th ed., CRC Press Boca Raton, FL, **1974**.

[2] J. Israelachvili, *Intermolecular and Surface Forces*, 2nd ed. Academic Press, London, **1991**.